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January 29, 2009

Gloria D. Smith
Adams Broadwell Joseph & Cardozo
601 Gateway Boulevard, Suite 1000
South San Francisco, CA 94080

Re: Review of the California Energy Commission's December 2008 Preliminary Staff Assessment for the Carlsbad Energy Center Project

Dear Ms. Smith,

Per your request, I have reviewed the Preliminary Staff Assessment ("PSA") for the Carlsbad Energy Center Project ("CECP" or "Project") which was released by the California Energy Commission ("CEC") on December 11, 2008.¹

I would first like to emphasize that developing meaningful and accurate comments on the PSA's air quality section is presently impossible because the PSA is deficient in that the Project description submitted by NRG Energy, Inc. ("the Applicant") to the CEC and relied upon by CEC staff to draft the PSA does not accurately reflect all aspects of the CECP's proposed operations. The Preliminary Determination of Compliance ("PDOC") issued by the San Diego County Air Pollution Control District ("SDCAPCD" or "District")², for example, evaluated a number of operational scenarios that had not been fully disclosed or explained in the Application for Certification ("AFC"), responses to data requests, or any other documents the Applicant had submitted to the CEC. In addition, on January 5, 2009, almost four weeks after release of the PSA and more than six weeks after release of the PDOC, the Applicant submitted comments on the District's PDOC that included substantial new information on critical aspects of the CECP's operational modes and associated emissions that had not been previously evaluated in either the PDOC or the PSA. To account for this new information, the Applicant suggested a number of substantive revisions to permit operating conditions proposed in the PDOC. Evidently, CEC Staff had not been apprised of any of this information during their preparation of the PSA.

¹ California Energy Commission, Preliminary Staff Assessment, Carlsbad Energy Center Project, Application for Certification (07-AFC-6), San Diego County, CEC-700-2008-014-PSA, December 2008.

² NRG, Letter to Steven Moore, San Diego Air Pollution Control District, Re: Comments on the Preliminary Determination of Compliance for the Proposed Carlsbad Energy Center Project, January 5, 2009.

On January 22, 2009, CEC Staff submitted Data Request Set #4 to the Applicant which addresses issues related to the inadequately described operational scenarios presented in the District's PDOC and issues raised by the new information supplied by the Applicant in its January 5, 2009 comment letter on the PDOC.³ Staff's data requests covered some of the same issues the Applicant's January 5, 2009, comment letter raised during my review. (Unfortunately, Staff's Data Request Set #4, which was docketed on January 22, 2009, was not immediately distributed via the docket distributor list or posted on the CEC's website as a download link. I only by chance discovered that Staff's data requests had been released on the CEC's docket list. The document was made available on the CEC's website on January 27, 2009 after I requested a copy from the CEC's project manager for the CECF, Mike Monasmith.) The Applicant has until February 23, 2009 to submit written responses to Staff's data requests.

The Applicant's responses to CEC Staff's data requests have the potential to substantially change or even invalidate the air quality modeling contained in the PSA and may require substantive revisions of the PSA. For example, Staff's Data Request No. 157 specifically requests the Applicant to demonstrate that increased NOx emission levels requested for transient load events would not result in impacts greater than those already modeled and analyzed in the PSA for worst-case 1-hour NOx emission events. Further, as discussed below, information provided by the Applicant casts doubt on the ability of the proposed plant setup to comply with the emission limits set by the CEC and SDAPCD, potentially requiring a revision of the PSA's alternatives analysis. It is therefore premature to comment on the December 2008 PSA before having a chance to review the Applicant's responses to CEC's data requests and before CEC Staff makes a decision on whether the responses necessitate a revision of the PSA.

Some of the issues raised by discrepancies between operational scenarios analyzed in the CEC's PSA and the District's PDOC and the new information provided by the Applicant's in its comments on the PDOC are discussed below in addition to general comments on the PSA and the Project. Some or all of these issues may be resolved by information supplied by the Applicant in response to CEC Staff's Data Request Set #4.

I. Definition of Startup Period

Both the PSA and the District's PDOC define a startup period as the period of time that begins when fuel flows to the combustion turbine following a non-operational period not to exceed 60 consecutive minutes.⁴ This definition does not address the variability of startup times depending on turbine temperature (cold, warm, hot start)

³ California Energy Commission, Carlsbad Energy Center Project (07-AFC-6), Air Quality Data Request Set #4, January 22, 2009.

⁴ PSA, AQ-11, p. 4.1-67 and PDOC, Appendix C, Condition 11.

and appears to be at odds with information provided by the Applicant that under the CECF's proposed daily cycling duty (plant shut down for 8 hours per day), the turbines would be able to reach full load in approximately 45 minutes for a hot start and approximately 125 minutes for a cold start.⁵ Further, the turbine manufacturer Siemens provided estimated duration per startup event under different ambient temperatures for the CECF's proposed STG6-5000 turbines and estimated the time from gas turbine ignition through 100 percent load at 22 minutes including a 10-minute period by which time it is assumed that emissions would be in compliance.⁶ Based on this information, the proposed definition of a startup period to include up to 60 minutes appears to be overly lenient. The Applicant should be required to supply additional information on emission levels for all startup scenarios (cold, warm, and hot) and at different ramp rates for loads from zero to 100 percent to better define the startup period and to avoid permitting excess periods during which the turbines are capable of but not required by permit conditions to comply with the 2 ppm BACT NO_x limit for normal operations. (Similar to the manufacturer information included in the Applicant's comment letter on the PDOC.)

II. Number of Startup and Shutdown Events

Based on the Applicant's proposed typical operating scenarios, the PSA determines maximum annual emissions from the CECF based on the assumption that each turbine operates up to 4,100 hours per year, of which 300 hours are for startups, 300 hours are for shutdowns, and 3,500 hours are for steady-state full-load operation at annual average base conditions.⁷ Yet, both the PSA and the PDOC incorporate a condition, PSA AQ-47 and PDOC Condition 47, which limit the number of startups for each turbine to 1,460 events per year. Combined with the definition of a startup period contained in PSA AQ-11 and PDOC Condition 11, which limits the duration of a startup period to 60 consecutive minutes, this provision potentially permits operation of each turbine under startup conditions of up to 1,460 hours per year. A total of 1,460 startup events would also require a total of 1,460 shutdown events, which based on the limit on the duration of a shutdown event of 35 minutes as defined in PSA AQ-10 and PDOC Condition 10, would amount to 852 hours per year. Thus, the CECF could potentially be operated for up to 2,311 hours per year under conditions that are exempt from compliance with the 2 ppm NO_x emission limit for normal operations. (Neither the PSA nor the PDOC contain a limit on annual numbers of shutdown events or annual hours of normal operational periods.) This inconsistency is not explained in the PSA. Consequently, potential annual emissions from the Project under startup conditions and shutdown conditions as presented in the PSA may be underestimated. While the Applicant would still have to comply with facility-wide annual emission limits, this potentially drastically increased number of startups and shutdowns would considerably

⁵ PSA, p. 5.3-4.

⁶ AFC, Appendix 5.1B, Table 5.1-B.

⁷ PSA, p. 4.1-27 and Table 18, p. 4.1-28.

reduce the percentage of time under which the turbines would have to comply with the BACT emission limits of 2 ppm NO_x for normal operations. For example, for 300 hours of startups and 300 hours of shutdowns, as discussed in the PSA, the total permissible time operating in excess of the 2 ppm NO_x limit would be about 17 percent of the total of 3,500 operating hours.^{8,9} In the case of 1,460 startups and the corresponding 1,460 shutdowns, the time remaining for normal operations without exceeding the annual facility limits would be limited and only make up a small percentage of the Projects operations. This issue should be resolved in a revised condition.

III. Transient Load Changes

The Applicant requested short-term excursions from the BACT emission limit of 2 ppm NO_x to account for periods with rapid load changes, so-called transient periods. The District's PDOC conditions define transient load changes when the turbine exceeds a 50 Megawatt per minute ("MW/min") load change and includes provisions to permit transient load conditions to meet the 2 ppm BACT NO_x, CO, and VOC emission levels with a 3-hour averaging period rather than a 1-hour averaging period for normal operating conditions. The Applicant's January 5, 2009 comment letter discloses that the turbines cannot meet the NO_x BACT levels of 2 ppm at load changes as low as 5 MW/min. (The Applicant supplies no information on whether CO and VOC emissions are similarly affected.) Therefore, the Applicant requests to replace the 2 ppm NO_x emission limit with a 12 ppm NO_x emission limit for transient conditions and redefines the transient period as exceeding a 10 MW/min load change for a total of 15 hours per year per turbine.¹⁰ The Applicant further requests that the 3-hour averaging period for transient loads be replaced with a 1-hour averaging period that excludes minutes during transient conditions.¹¹

In addition to considerably altering the conditions under which the turbines would not have to meet the 2 ppm NO_x BACT limit, it appears that the Applicant's proposed definition of a transient period as exceeding a 10 MW/min load change may not be realistic. In fact, based on the data supplied by Siemens it appears that even minimal load changes, *i.e.* considerably smaller than 5 MW/min, would result in non-compliance with the 2 ppm NO_x BACT limit. Specifically, Siemens data show that for every 5 MW/min load change above 60 percent load, uncontrolled NO_x emission levels increase by about 4 ppm to about 13 ppm at 15 percent oxygen above the nominal steady state level of about 9 ppm at 15 percent oxygen. (Steady-state uncontrolled NO_x levels of 9 ppm controlled by an selective catalytic reduction ("SCR") system are below 2 ppm.) The Siemens data show that uncontrolled NO_x emission levels increase during both negative and positive load changes. The manufacturer notes that higher ramp rates

⁸ $(300 + 300) / 3,500 = 0.17$.

⁹ Not accounting for transient periods, low-load operations, tuning or other exempt conditions.

¹⁰ NRG PDOC Comment Letter, Proposed Condition XX.

¹¹ NRG PDOC Comment Letter, Proposed Condition 28.A.

as well as higher turbine inlet temperatures can be expected to result in even larger NO_x emission levels of up to 20 ppm. The manufacturer also notes that the potential additional time delay with an SCR system could extend the length of the transient. In other words, because of the lag time associated with the response of the SCR system to achieve steady state levels of 2 ppm NO_x, the time period during which the turbine would not meet its 2 ppm BACT NO_x emission level may be longer than the time period during which the actual load change occurs. However, the Applicant's proposed definition of transient periods only accounts for the time period during an actual load change, not for the lag time of the SCR system. While actual emissions during would count towards cumulative emission limits, the time period exceeding the steady state operating emission limit of 2 ppm NO_x would not be detected. Thus, the actual time period above 2 ppm NO_x BACT emission levels as a result of load changes may exceed the 15-hour limit proposed by the Applicant for transient operations.

To address these issues, additional information for NO_x, VOC, and CO emission levels during transient periods at various ramp rates and load levels before and after the SCR system is required. Alternative turbine configurations that better meet the Applicant's objectives of frequent startups and expected variations in ramp rates should also be evaluated.

IV. Rapid Response Startup and Shutdown Times

Both the proposed CECP and the proposed El Segundo Power Redevelopment Project proposed to use two Siemens STG5-6000 turbines with rapid-response technology with a total nominal generating capacity of about 560 MW. According to the Applicant, these turbines are able to reach full load and operate at a combined cycle efficiency of approximately 55-56 percent in approximately 45 minutes for a hot start and approximately 125 minutes for a cold start. Yet, to calculate maximum hourly emissions associated with startup and shutdown, the Applicant relies on different data. For the CECP, the Applicant calculates maximum hourly emissions for startups based on 22 minutes of elevated emission levels followed by 38 minutes of normal operating emission levels.¹² The 22 minutes of elevated emissions were based on vendor-supplied data for startups at 62 and 41 F.¹³ For the El Segundo project, the vendor-supplied data show a considerably lower startup period of 12 minutes at 62 and 41 F.¹⁴ Neither the Applicant nor the PSA addressed these dissimilar startup periods for essentially the same turbine configuration.

¹² PSA, p. 5.1-32.

¹³ El Segundo Power, LLC, Application to the South Coast AQMD for a Determination of Compliance and Permit to Construct for the El Segundo Power Redevelopment Project, June 2007, Appendix 5.1B, Table 5.1B-7.

¹⁴ Appendix I, CTG Vendor Supplied Startup/Shutdown Emissions.

V. Secondary PM10 Emissions

The PSA states that PM10 emissions “are not estimated to be higher or lower during startup and shutdown events than during normal operation.”¹⁵ However, elevated NOx emissions during the Project’s proposed frequent startup and shutdown periods would contribute to formation of secondary particulate matter. Therefore, the Applicant should be required to quantify the potential formation of secondary PM10 (or PM2.5) and the information should be incorporated into the PSA.

Conclusion

As discussed above, due to lack of critical information available to CEC staff at the time of preparation of the PSA and the late and incomplete submittal of additional information by the Applicant, it is premature to make comments on a document that may need substantial revisions. In addition, there are a number of issues that warrant further review after these deficiencies have been addressed.

Regards,

A handwritten signature in black ink, appearing to read "Petra Pless", with a large, stylized flourish above the name.

Dr. Petra Pless

¹⁵ PSA, p. 4.2-26.